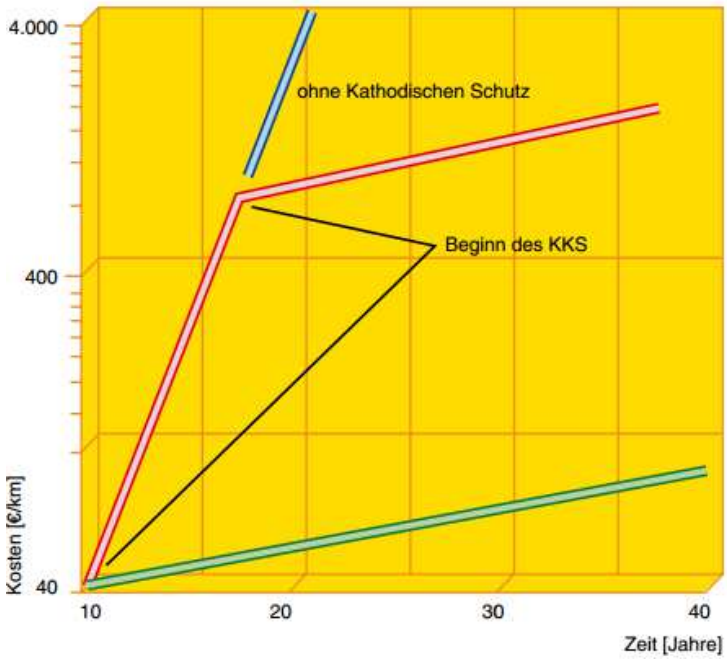

Abb. 3 Vergleich der Kosten durch Korrosionsschäden und Kosten des KKS

Die spezifischen Kosten eines Kathodischen Korrosionsschutzes hängen von mehreren Faktoren ab. So ist nicht nur die Länge der zu schützenden Rohrleitung ausschlaggebend, sondern auch das Alter des Netzes und ob bereits eine Teilerneuerung an der Pipeline vorgenommen wurde oder nicht.

Grundsätzlich kann man mit Kosten von etwa 4 - 15 % der Investitionssumme der Rohrleitung rechnen. Dieser Betrag steht jedoch in keinem Verhältnis zu den Kosten für die Behebung möglicher Schäden oder Produktionsausfälle.

Die Wirtschaftlichkeit von Kathodischem Korrosonsschutz kann durch die Grafik oben verdeutlicht werden So bewirkt auch ein nachträglich instalierter Korrosionsschutz an älteren Rohrleitungsnetzen eine deutliche Reduzierung der Instand setzungs- und Wartungskosten.

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RESEARCH OF MAGNETIC ANOMALY NATURE IN THE AREA OF TPU TRAINING GROUND FOR GEOLOGICAL INTERNSHIPS

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The training ground for geological internships of Tomsk Polytechnic University is located in the Republic of Khakassia lakeside Sobachje (Fig. 1), 20 km southwards the village Shire. Its area comprises 5,000 km2 and is located at the junction of Salairsky fold structures of the Kuznetsk Alatau and Hercynian Minusinskiy intermountain depression where successfully combined simple and complex in its structure and availability geological sites, including numerous deposits and occurrences of gold, copper, molybdenum, tungsten the richest mineralogy [1].

Geosynclinal structural complex is formed by Late Precambrian and Cambrian depositions, ultrabasite intrusions and batholith granitoids. Transient structural complex is characterized by Devonian and Carboniferous depositions with numerous intrusions of basic, acid and alkaline composition. The platform stage of development caused formation of kimberlite pipes [2].

The internship conducted within this territory gives the students opportunity to develop skills of geological mapping and learn about the geological structure of the area and its ore occurrences.

For the second-year students of geophysics department the internship involves four weeks of practical training and route walks. The whole training period is divided into two parts which last for two weeks each. At the first stage, the students study the geology of the area, find out the basic information about ore occurrences and depleted deposits. They

do on-route ground surveying and take samples for their further description. The result of the first stage is the compilation of a geological map using the scale 1:50000, in which the students render the geological structure of the study area.

Fig. 1 TPU practice ground area.
● -Location of prospect for magnetic survey

While determining the element occurrence of rocks on the outcrop the compass needle happened to deflect from its true position by 90 degrees. This occasion turned into the subject of special consideration and eventually, it was suggested that magnetic mineralization presence in the outcrop can cause the magnetic field of granodiorites.

Thus, the main purpose of the investigation was defined as determination of the presence and nature of the magnetic anomaly. This can be achieved by accomplishing a number of objectives:

1. to explore a rock outcrop with magnetometer mmp-203 and process the obtained data, produce a contour plot;
2. to select oriented samples and explore their mineral composition in thin sections and polished sections;
3. to make conclusions about the nature of the magnetic anomaly.

Magnetic prospecting was carried out on the plot, 40 m * 50 m in size (see Figure 1). Basic profile pitch is 10 * 2 meters, that one of detailing profiles comprises 2 * 1 meter. The surveys along six basic profiles were completed supplemented by eleven detailing profile surveys necessary for specification of the anomaly structure.

After excluding the values of the background component magnetic field from the observation, it was possible to detect the anomalous zone (Fig. 2).

The anomalous zone has sublatitudinal distribution and it represents a dipole with extreme values of induction reaching 1305 nT and 2151 nT. The sections with such values are situated in proximity and are located on the West of the study area.

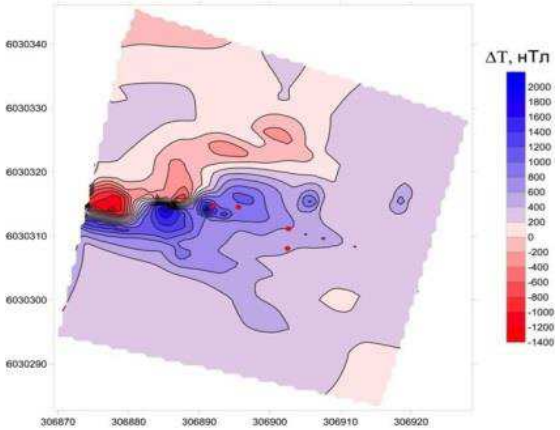

Fig. 2 *Δ*T isodynams plan of survey area

The oriented samples from the outcrop were selected within the most intense part of the anomalous zone. They are required to reveal the nature of the anomaly (ratio of remnant and induced magnetization and the spatial orientation of the magnetization in natural occurrence of rocks).

The nature of magnetic anomalies at the first approximation can be determined judging by the mineral composition of rock samples which was identified as a result of the analysis of thin sections and polished sections.

Using a microscope it is possible to clearly observe hypidiomorphic dioritic composition in the analysed thin sections. Idiomorphism series is well expressed; one can detect wide tabular crystals of plagioclase, hornblende, which are interlayered with xenomorphic quartz grains filling irregular sections between older rock minerals.

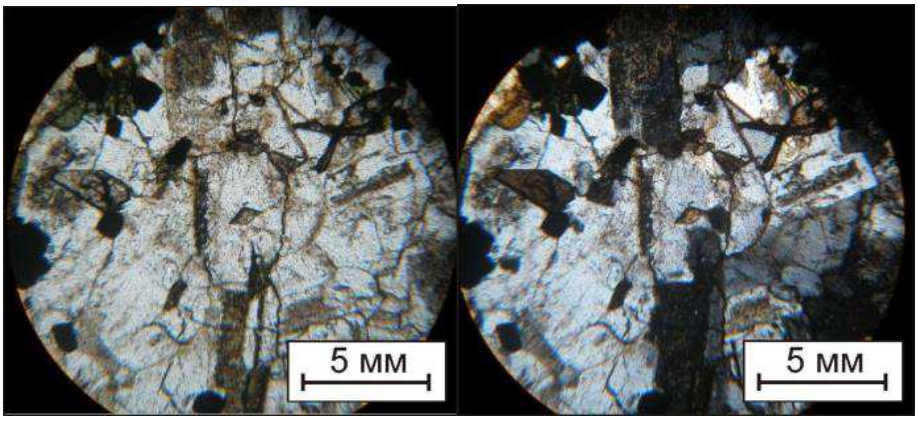

***Fig. 3 Thin section sample № 2. Wedge*-shaped sphene inclusion in plagioclase crystals observed using light (left) and dark-field microscopy (right)**

The rock consists of plagioclase - andesite (50%), in smaller quantities there is normal hornblende (30%), quartz (10%). The percentage (about 10%) of ore mineral (as may be supposed magnetite (10%)) and accessory minerals like sphene is noticeably high.

In the samples studied in the reflected light there are inclusions of ore mineral - magnetite which have regular isometric octahedral shape. The clusters of grains frequently form aggregates up to 1-2 mm. In particular cases, the decay structure represented by hematite plates can be observed in magnetite.

The analysis of ΔT isodynams plan of the survey area makes it possible to draw a number of conclusions. The most intense anomalous zone has a relatively small area of about 400 m2, sublatitudinal distribution and it is located in the western part of the study area. Based on the assumption that there is one anomalous body, one can conclude that it has a steep dip. This conclusion is based on the spatial proximity of the anomalous field extremum points. The closer they are, the steeper the dip angle of the body provided that there is on-dip magnetization.

Taking into consideration the spatial location, both positive and negative values may indicate that the zone of ore mineralization occurs at a certain angle to the surface. The dip angle of ore mineralization area depends on the extreme values of induction, particularly in-between angle and in this case it is approximately equal to 50^0 (maximum dip angle). Furthermore, the observation of isodynams can reveal that the zone of ore mineral intrusion is more likely to have a plate-like shape. This is indicated by the position of local extreme isodynam values on the plan. Punching of ore minerals resulted most probably from contact metasomatism, which confirms the fact that the analyzed diorite outcrop is close to a granitic intrusion.

Thus, the magnetic field anomaly is caused by magnetite mineralization. The investigation permitted to determine the approximate angle of dip of ore formation and peculiarities of ore mineralization occurrence.

The further research in the laboratory would be devoted to the analysis of physical parameters of samples that will give information about the exact angle of dip and uniformity of mineralization, as well as about the nature of the studied anomalies in general.

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COMPUTATION OF STRESSEDLY-DEFORMED SECTORS OF A PIPELINE IN THE PROCESS OF LAYING ON THE SEABED

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Nowadays the main promising exploitations of oil and gas fields in the Russian Federation are carried out in the northern seas. Due to the depletion of the known land deposits and a growing need in the oil and gas offshore exploitations are intensified and the amount of produced oil and gas is rising up. That point is proved by statistics data of 2012: almost 30 % of oil and gas in the world is extruded from the sea [1].